Exploding Stars: Threat to Earth Lower But Still Real

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There are plenty of potential perils for Earth and its inhabitants, from the threat of global warming to the potential for a deadly asteroid strike or a devastating nuclear disaster. So it's nice to hear about a risk that's gone down a bit.

Since the early 1970s, astronomers have speculated about the danger posed to our planet by exploding stars called supernovae. Among the negative aspects to such an event would be the sudden depletion of Earth's protective ozone layer, the thinking goes. Left naked to space, we might then be fried by the UV rays of our own Sun.

Researchers have suggested that one or more mass extinctions during the past few hundred million years might have been triggered by supernovae, and that it might happen again.

But a new and detailed set of calculations shows that such events are probably extremely rare.

The study, led by Neil Gehrels of NASA's Goddard Space Flight Center, found that for a supernova to significantly deplete ozone it would have to occur within 26 light-years of our planet. Other data shows that this happens only about once in a billion years.

"This particular pathway for mass extinctions may be less important than previously thought," Gehrels and his colleagues write in a paper to be published in the March 10, 2003 issue of the ***Astrophysical Journal***.

The standard supernova is not the only risk factor posed by stellar explosions, however.

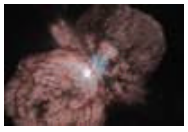
Details of the study

The researchers modeled the detailed chemical reactions that go on when a supernova's energy reaches Earth's atmosphere, and they also examined how much energy would actually survive a trip across space and get here.

The dangerous output of a supernova involves gamma rays, the most energetic form of light, plus cosmic rays that arrive in the form of particles, explains John Cannizzo, another Goddard researcher who worked on the study. The emissions interact with nitrogen gas in Earth's atmosphere and break it into atomic nitrogen and subsequently nitrogen oxides, which in turn break down ozone.

"When one considers together all the ingredients which go into the complete picture

Images



This massive supernovae, Eta Carinae, is less than 8,000 light years away. It doubled in brightness in less than 18 months recently. Yikes.

Do gamma ray bursts cause mass extinctions? Without question, the answer is probably yes or no, according to the experts. But most would tell you that it was an asteroid, not a GRB, that did the dinos in. That's one view that has changed and become firm since the discovery of proof -- a crater in Mexico.

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for ozone depletion from nearby supernovae, Cannizzo told ***SPACE.com***, "the total depletion of ozone is not all that great."

There's a bit of wiggle room in the results.

"The precise results depend sensitively on many assumptions, but it's the best we have right now," John Scalo, from the University of Texas at Austin, who was not involved in the work but is familiar with it.

Other worries

There are other possible ill effects of supernovae and other energetic astronomical events that were not considered in the new study. Separate research has shown that exposure to high-energy particles from space, over time, could cause genetic mutations. Mutations are not always a bad thing, however. Scientists consider some mutations to be beneficial or at least normal aspect of evolution.

Another worry are so-called hypernovae, which are related to mysterious gamma-ray bursts in deep space. Astronomers believe these are similar to supernovae but that a beam of concentrated energy, emanating along the star's axis of rotation, happens to be pointed at Earth.

Though the new study did not look into the hypernovae hazard, Gehrels said it's likely for one aimed at Earth to occur once every couple of hundred million years somewhere in our galaxy, most of the time at a very large distance from our planet, however.

Here's how the estimate is figured: A setup called the Burst and Transient Source Experiment (BATSE) aboard NASA's Compton Gamma-Ray Observatory detected gamma-ray bursts (and presumably the associated hypernovae) at the rate of about 500 per year, or just more than one per day, in the observable universe, out to about 14 billion light-years.

Given that there are some 100 billion galaxies in that space, this rate translates into about one gamma ray burst from inside our galaxy beamed toward Earth every 200 million years. Because the energy is so concentrated compared to a normal supernova, hypernovae could potentially be harmful to life on Earth at much greater distances than supernovae.

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